Georgia State Board of Examiners for Certification of Water and Wastewater Treatment Plant Operators and Laboratory Analysts

Wastewater Treatment Plant Operator Need-to-Know
Class I, II, and III

Note: Many of the topics covered on the Class III, Class II, and Class I exams are the same. The questions asked on the Class II exam may be more detailed than those on the Class III, and those on the Class I exam may be more detailed than those on the Class II exam. Class II examinees also need to be familiar with the information on the Wastewater Laboratory Analyst Need-to-Know.

Characteristics of Wastewater

Class III, II, and I

- Appearance
- Potential health affects
- Physical characteristics
    - Solids
    - Temperature
- Potential dangerous gases
- Effects on receiving waters

Collection System

Class III, II, and I

- Types of sewer systems
    - Combined
    - Sanitary
    - Storm
- Components
    - Backflow prevention devices
    - Cross-connections
    - Force mains
    - Gravity sewers
    - Lift stations
    - Main sewers
    - Manholes
    - Measuring and control systems
    - Outfalls
    - Pipes
        - Types
        - Joints
        - Roughness coefficient
    - Valves
- Flow measuring devices
- Flow monitoring and control
- Velocity in sewer
    - Minimum
    - Optimal

- Infiltration
- Inflow
- Exfiltration
- Odor control
- Grease problems
  - Causes of
  - Prevention of
- Septic conditions
  - Causes
  - Indicators of
  - Problems caused by
- Stoppage removal
- Root removal

Wastewater Treatment Processes

For the following treatment processes, know:

- Purpose
- Types
- Related equipment
  - Proper operation
  - Start-up and shut-down procedures
  - How to recognize abnormal operation
  - What to do if it is not operating properly
  - Proper maintenance procedures for the equipment
- Basic principles behind how the treatment process works
- How to recognize and troubleshoot abnormal conditions
- How to collect samples and interpret laboratory results
- How to read related charts, meters, and gauges
- Regulatory requirements

Waste Treatment Ponds

Class III, II, and I

- Information listed above

Preliminary Treatment

Class III, II, and I

- Screening
- Shredding
- Grit Removal

Flow Measuring

Class III, II, and I

- Parshall flume
- Weirs
- Venturi meter
- Magnetic flowmeters

Primary Treatment

Class III

- Sedimentation

Class II and I

- Class III topic
- Flotation

Secondary Treatment

Class III and II

- Trickling filters
- Conventional activated sludge
- Package plants
- Oxidation ditches
- Rotating biological contactors
- Secondary clarification

Class I

- Class III and II topics
- Pure oxygen activated sludge

Solids Handling and Disposal

Class III, II, and I

- Digestion
    - Aerobic
    - Anaerobic
- Dewatering
    - Drying beds
    - Sludge lagoons
    - Land application
    - Mechanical dewatering
        - Vacuum filter

        - Centrifuge
        - Belt press

- Sludge disposal
    - Land application
    - Surface disposal
    - Incineration
    - Composting

Disinfection and Dechlorination

Class III

- Chlorination
- Hypochlorination
- Ultraviolet disinfection
- Dechlorination with sulfur dioxide

Class II and I

- Class III topics
- Ozonation

Additional Treatment Processes

Class III

- Odor control
- Solids removal from secondary effluents
    - Chemical removal techniques
        - Coagulation
        - Flocculation
        - Sedimentation
    - Microscreens
    - Gravity filtration

Class II and I

- Phosphorus removal
- Nitrogen removal

Laboratory

Collect Samples and Interpret Analysis

For the following parameters, know:

- If analytical results are normal or abnormal
- Regulatory sample collection and preservation procedures
- Normal characteristics of water

Class III, II, and I

- Alkalinity
- Ammonia
- Biochemical Oxygen Demand
- Chemical Oxygen Demand
- Chlorine residual
- Conductivity
- Dissolved Oxygen
- Fecal Coliform Bacteria
- Metals
- Nitrate/Nitrite
- Oil & Grease
- Organics
- Oxidation Reduction Potential
- pH
- Phosphorus
- Total Dissolved Solids
- Total Kjeldahl Nitrogen
- Total Suspended Solids
- Turbidity
- Volatile Acid/Alkalinity

Perform Regulatory and Plant Process Control Laboratory Analysis

For the following parameters, know:

- How to calibrate and use appropriate laboratory instrumentation
- How to correctly perform the analysis
- The appropriate laboratory ware to use
- Quality assurance procedures
- How to perform related laboratory calculations
- Where to find regulatory-approved procedures
- What can interfere with proper analysis
- How to properly document analysis and results

Class III

- Alkalinity
- Chlorine residual
- Conductivity
- Dissolved Oxygen
- Oxidation Reduction Potential
- pH
- Volatile Acid/Alkalinity

Class II and I

- Ammonia
- Biochemical Oxygen Demand
- Chemical Oxygen Demand
- Fecal Coliform Bacteria
- Nitrate/Nitrite
- Phosphorus
- Total Dissolved Solids
- Total Kjeldahl Nitrogen
- Total Suspended Solids
- Turbidity

Laboratory Apparatus and Equipment

For the following laboratory apparatus and equipment, know:

- Which laboratory tests use the apparatus or equipment
- How to operate the apparatus or equipment
- Frequency and procedure for calibrating the apparatus or equipment
- How to maintain the apparatus or equipment
- Frequency and procedure for cleaning the apparatus or equipment
- How to properly store the apparatus or equipment
- Basic theory behind how the equipment operates
- How to troubleshoot equipment

Class III

- Buret
- Computers
- Conductivity Meters
- Dissolved Oxygen Meters
- Fume Hoods

- Laboratory Glassware
- Microscope
- pH Meters
- pH Probes
- Thermometer
- Volumetric Glassware

Class II and I

- Autoclaves
- Balances
- Desiccators
- Digestion Apparatus
- Distillation Apparatus
- Drying Ovens
- Incubators
- Ion Selective Electrodes
- Muffle Furnaces
- Spectrophotometer
- Turbidimeter
- Waterbath
- Water Purification Equipment

Equipment Operation, Maintenance, and Troubleshooting

For the following pieces of equipment, know:

- Proper operation
- Start-up and shut-down procedures
- How to recognize abnormal operation
- What to do if it is not operating properly
- Basic principles behind how it works
- Proper maintenance procedures
- How to read related charts, meters, and gauges

Class III, II, and I

- Blowers, compressors, and pneumatics
- Chemical feeders
- Chlorinators
- Cross-connection control devices
- Computers
- Electronic testing equipment
- Flow monitoring equipment
- Generators

- Hydraulic equipment
- Instrumentation
- Pumps and motors
    - Types of pumps
    - Pump and motor components
    - Factors that influence type of pump to use
    - Types and correct locations of pressure gauges
    - Maintenance records
    - Improper operation
    - Cavitation
    - Head
        - Dynamic
        - Pressure
        - Static
- Valves

Safety and Security

Class III, II, and I should be able to perform security and safety procedures related to

- Confined space entry
- Manhole safety
- Location of underground utilities
- Chlorine safety
- Electrical hazards and safety
- Lock-out/tag-out
- First aid
- Use of Self Contained Breathing Apparatus (SCBA)
- Fire extinguishers
- Proper storage of chemicals, including lubricants and fuels
- Material Safety Data Sheets
- Chemical spill response
- Facility upset
- Pathogens/infectious materials
- Personal protective equipment
- Eyewashes and showers
- Unsafe atmospheric conditions
- Dangerous gases
    - Hydrogen sulfide
        - Causes
        - Characteristics
    - Methane
        - Causes
        - Characteristics

Class III should be able to perform administrative procedures, such as

- Administer compliance, emergency preparedness, and safety programs
- Develop operation and maintenance plan
- Plan and organize work activities
- Record and evaluate data
- Respond to complaints
- Write regulatory authority reports

Class II and I should be able to perform administrative procedures, such as

- Class III topics
- Develop budget

Mathematics

Class III

- Area
- Volume
- Volume conversions (cubic feet to gallons and gallons to cubic feet)
- Velocity and flow
- Chlorine dosage rates
- Flow conversions
- Head to psi conversion and psi to head conversion
- Surface overflow rate
- Solids loading rate
- Organic loading rate
- Hydraulic loading rate
- Detention time
- Percent removal
- Weir overflow rate
- Sludge volume index
- Wasting rate
- Plant efficiency
- Recirculation ratio

Class II and I

- Class III problems
- Temperature conversions
- Filtration rate
- Sludge age
- Solids retention time
- Mean cell residence time
- Food/microorganism ratio
- BOD calculations

- Total suspended solids calculations
- Geometric mean

Definitions

Class III

- Acid
- Activated sludge
- Adsorption
- Aerobic
- Air gap
- Alkaline
- Alkalinity
- Ambient temperature
- Anaerobic
- Anion
- Backflow
- Base
- Breakpoint chlorination
- Buffer
- Cation
- Chain-of-custody
- Chloramines
- Chlorine demand
- Chlorine dose
- Chlorine residual
- Coagulation
- Coliform bacteria
- Composite sample
- Cross-connection
- Denitrification
- Diffusion
- Disinfection
- Effluent
- Electrical terms
    - Amp
    - Hertz
    - Ohm
    - Volt
    - Watt
- Facultative
- Fecal coliform bacteria
- Filtrate

- Flocculation
- Grab sample
- Hydrologic cycle
- Indicator organism
- Infiltration
- Inflow
- Influent
- Inorganic
- Nitrification
- Normality
- Meniscus
- POTW
- Pathogen
- Pin Floc
- Reverse osmosis
- Rotameter
- Septic
- Sludge bulking
- Solute
- Solvent
- Specific Gravity
- *Standard Methods for the Examination of Water and Wastewater*, published by AWWA, APHA, and WEF
- Sterilization
- Titrant
- Titration
- Velocity
- Vulnerability assessment

Class II and I

- Bioassay
- Catalyst
- Colloidal
- Endogenous respiration
- Kjeldahl nitrogen